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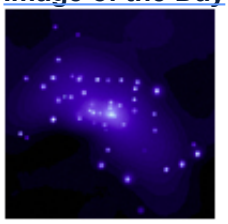

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SPACE NEWS

Australian-Based "CANGAROO" Telescope Finds Halo Of Gamma Rays

February 28, 2003 11:15AM CDT

A nearby jewel of a galaxy famous for its furious rate of star formation and star explosions sits within a halo of ultra-hot gamma rays, a team of Japanese scientists has found.

The observation of galaxy NGC 253 marks the first time that scientists have detected gamma rays of such high energy from a galaxy similar in size to our own. These gamma rays, a form of light, are likely created by cosmic rays, subatomic particles moving close to light speed. The observation, the team says, provides compelling evidence that the primary source of cosmic rays in the Universe, a long-standing mystery, are star explosions.

A team led by Dr. Chie Itoh of Ibaraki University in Japan discusses these findings in the February 20, 2003, issue of Astrophysical Journal Letters. The observation took place in the Australian outback with an innovative telescope called CANGAROO-II and relied on data archived at NASA Goddard Space Flight Center in Greenbelt, Md. The observation also shows how ground-based telescopes such as CANGAROO-II can support NASA's Gamma-ray Large Area Space Telescope (GLAST), planned for a 2006 launch.

Gamma rays are the most energetic form of light, capping the electromagnetic spectrum that runs from low-energy radio waves through infrared and optical light, and past ultraviolet and X rays. Gamma rays are millions of times more energetic that what the Hubble Space Telescope can detect.

Gamma rays are usually observed from space with satellites because the Earth's atmosphere blocks most gamma rays from reaching the Earth's surface. The highest-energy gamma rays, however, do penetrate

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into the atmosphere. These bullet-like photons (light particles) collide with molecules in the atmosphere to create a shower of secondary particles.

CANGAROO-II detects this particle shower and reconstructs the flow of gamma rays that created the shower. The highest-energy gamma rays are rare, and very large telescopes such as CANGAROO-II are needed to analyze them.

The CANGAROO team (comprising scientists from Australia and Japan) turned CANGAROO-II towards NGC 253, a starburst galaxy approximately eight million light years from Earth. Because of its high rate of star explosions and, thus, theorized cosmic-ray activity, this galaxy was suspected to emit higher-energy gamma rays -- at what scientists call the TeV level. (This stands for tera-electron-volt, a trillion electron volts. Optical light particles carry an energy of only about one electron volt.)

Itoh and her group analyzed these TeV gamma rays along with a complete spectrum of emission, from radio through X rays, under a collaboration with Dr. Takeshi Tsuru of Kyoto University, a co-author on the report. Some of this lower-energy spectrum of emission is also produced by cosmic-ray interaction.

This complete multiwavelength analysis provides a total picture of cosmic-ray activity in NGC 253 and strongly bolsters the star explosion / cosmic-ray origin theory, said co-author Dr. Tatsuo Yoshida of Ibaraki University.

"The paper by C. Itoh et al. presents exciting new data to help us understand the cosmic ray distribution in galaxies," said Dr. Stanley D. Hunter, an astrophysicist at NASA Goddard. "The indication of very high energy electrons in an extended, galactic halo of NGC 253 may give us to a better understanding of a heretofore unobserved component of our own Galaxy, the Milky Way. The existence of a similar halo in the Milky Way may lead to an explanation of the excess diffuse gamma-ray emission toward the Galactic center observed with the EGRET instrument on the Compton Gamma Ray Observatory."

CANGAROO-II's detection of TeV gamma rays from NGC 253 also bodes well for the future of TeV astronomy, said co-author Dr. Ryoji Enomoto of Tokyo

University. Previously there were only 11 confirmed sources of TeV gamma rays; galaxy NGC 253 is now the 12th source, and it's not a particularly exotic source. This means that the Universe is likely rich in TeV gamma rays -- detectable with the current generation of improved TeV ground-based gamma-ray observatories such as CANGAROO.

"With CANGAROO-II, it's like we have propped open the window to the Universe by a few more inches, expanding our view," said co-author Dr. Shohei Yanagita of Ibaraki University.

CANGAROO-II represents a second-generation of TeV gamma-ray detectors now in operation. CANGAROO-II's increased sensitivity over CANGAROO, for example, is expected to uncover a multitude of new TeV sources and, at long last, fill out the multiwavelength analysis of the Universe. CANGAROO-II will extend the reach and complement observations from GLAST, which will observe gamma rays of a slightly slower energy compared to CANGAROO-II. GLAST, from its space-based perch, will notify ground-based observatories such as CANGAROO-II of newly discovered cosmic sources of gamma rays.

CANGAROO stands for Collaboration of Australia and Nippon (Japan) for a GAmma Ray Observatory in the Outback. More information about this observatory, including images, is available at: http://icrhp9.icrr.u-tokyo.ac.jp/index.html

A copy of the journal article is available at: http://xxx.lanl.gov/astro-ph/0301147

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